

Flash Disk Reliability

94-0031

JK microsystems' products are based on the DOS operating system. The use of DOS provides a level of familiarity and compatibility that reduces design cycles and additional learning.

DOS FAT file systems have some inherent limitations that must be considered in embedded applications. Reading from disk, flash memory on JK microsystems' SBCs, is a safe operation and requires no unique considerations with respect to long term product reliability. When writing data to disk, situations can occur that will compromise the integrity of the drive. This application note presents a few topics that should be considered when an application writes to the disk.

The primary concern when writing to disk is power failure (or controller reset) before completion of the write activity. When a file is not closed properly, the operating system may be unable to read data from that file or worst case it may corrupt the entire drive. This is as much an issue with any computer/disk/operating system combination as it is with an embedded SBC using a flash disk and DOS.

The ultimate goal is to be sure that power never fails while a file is open for writing. To this end, it is important to keep file writes short, close files when write activity is complete and to take the necessary steps to reduce the chance of power failure or watchdog reset during this time. In applications running on batteries or with potentially unreliable power, voltage monitoring and lockout circuitry as well as an auxiliary supply capable of powering the controller until a write finishes may be necessary.

JK microsystems' hardware provides a level of under-voltage protection. The flash memory will not be written to in the case of an abnormally low voltage. The BIOS also implements write protection schemes present in the flash memory to prevent inadvertent writes and keep the flash safe from bus noise. Unfortunately, these precautions cannot completely protect the disk if power fails during a write.

User applications must make every effort not to leave files open for writing open longer than necessary. To avoid unnecessary delays, consider the following:

- Format all data before opening the file
- Write as large a block as possible
- Consider caching data in RAM
- Be sure to handle the watchdog properly to avoid controller reset during writes
- Limit the chance a user can remove power during a write (in use indicator, etc.)

After data has been written, be sure to:

- Flush and close the file
- Issue a DOS disk reset after file has been closed

DOS disk reset is INT 21h, function 0Dh. This function is not clearly documented in DOS references. JK microsystems has seen an increased reliability when using this function after closing files. See the following example in C:

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```
#include <dos.h>
union REGS regs;

/* ... */

fclose(fp);          /* close the file */
regs.h.ah = 0x0D;    /* issue DOS disk reset */
intdos(&regs, &regs);
```

If a power cycle does interrupt a disk write, there is a good chance that there are errors in the disk structure. Either the FAT or directory table as well as the actual data could be corrupt. The CHKDSK utility can be used to verify the integrity of the drive and possibly repair a damaged file structure. This utility is available on the JK microsystems development kit CDrom.

The above information is by no means a guarantee that disk corruption could not occur. Every application that relies on writing information to disk should carefully evaluate the chances that a power failure or system reset could interrupt the disk write and perform tests to verify product reliability.

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